plasma pressure profile is fixed, and further increase in the power deposition does not result in a rise in its energy." Between these two limits, Kadomtsev makes the point that the density can be extended while maintaining the ohmic scaling law for confinement if the power deposition for the auxiliary heating only slightly perturbs the relaxed state profiles; sooner or later, however, the transition to degraded confinement must take place.

The book concludes with a discussion of reactor requirements by Toschi et al. and a paper by Palumbo on the nature and prospects of the Euratom fusion program. The discussion by Toschi et al., on the progression from JET to the Next European Torus (NET) to DEMO to a prototype commercial-sized reactor, addresses the extrapolations needed for each step. The nominal considerations of power density, confinement, particle and power load at the divertor, burn length, etc., have a universal character. Although here they are discussed in the direct context of NET, they apply as well to today's progression from TFTR/JET through the Compact Ignition Tokamak to the International Thermonuclear Engineering Reactor, and beyond. The authors believe that "among the physics issues the plasma power density (which is directly related to operating limits on beta, plasma density and plasma current), the power and particle loads on the walls of the device as well as the plasma exhaust requirements, and the prospects for steady-state operation, are of primary importance. Technologically the most severe requirements are in operational reliability, lifetime of plasma-facing components and remote-handling."

In the concluding paper by Palumbo, the reader can find a short discussion of the need for fusion reactors. It is interesting to read the European point of view on this topic, typified by the remark that the cost of all fusion programs in Europe for the entire year 1984 was only a little more than the cost of oil imports for 1 day. Palumbo reiterates the theme expressed in the preceding paper by Toschi et al. of the necessity for parallel development of technology in the areas of superconducting magnets, blanket and first-wall engineering, tritium technology, etc.

Perhaps as much as anyone in the world today, Palumbo can speak for the virtues (and difficulties) of international collaboration. Palumbo's comment regarding the Reagan-Gorbachev initiative toward wider international cooperation bears repeating.

> Of course, the engagement of the world fusion community will be a prerequisite, but it is also evident that a lot of political, managerial and administrative problems have to be solved. For this, good will and the commitment of the political authorities is necessary. However, we should avoid thinking that the solution of our problems can be in the hands of ambassadors and foreign ministers. The main problems remain with the physicists and engineers.

This reviewer thinks that is just the right note for the last chapter of this book.

Don J. Grove's first work in basic research was on ionization by electron impact, mass spectroscopy, and ultra-high vacuum (UHV) research. In 1954, Grove came on loan to the Princeton Plasma Physics Laboratory (PPPL) from Westinghouse Electric Corporation. Working with Lyman Spitzer, he was one of four scientist-engineers who made the first evaluation of controlled thermonuclear processes for power production and was a major contributor to the conceptual design reports on the C-Stellarator. He also planned, constructed, and put into operation at PPPL the first UHV laboratory for large systems. From 1960 to 1970, he was the physicist-in-charge of C-Stellarator operations. He managed the entire facility and generated more than 50 papers on plasma physics and controlled thermonuclear research. From 1970–1972, he managed a crash conversion of the C-Stellarator to the ST Tokamak and managed the operations for the project. More recently, Grove was project manager for the Princeton Large Torus, responsible for its design, fabrication, installation, and physics operations. He joined the TFTR project in May 1976 as deputy project manager and became manager in November 1982 after retiring from Westinghouse and joining Princeton University as a principal research physicist. In October 1986, he became deputy director for technical operations at the PPPL, stepping down from this position in January 1988 to work on special assignments involving the University, the U.S. Department of Energy, and local community officials.

Grove received his PhD in physics from Carnegie Mellon University in 1953.

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Superconducting Magnets

Author	Martin N. Wilson
Publisher	Oxford University Press, New York, New York (1983)
Pages	335
Price	$45.00 hardback, $23.95 paperback
Reviewers	Roger Boom and Y. M. Eyssa

Superconducting Magnets by Martin N. Wilson was published in 1983 and only recently has become generally available in the United States, either in hard cover or paperback. It is an outstanding text and reference treatise for engineers and is recommended to all *Fusion Technology* readers.

Superconductive magnet systems consist of turns of conductors wound or mounted to produce specific magnetic fields and field gradients. The engineering challenge is to provide adequate structure and cooling to maintain superconductivity during operation. A basic problem is heat deposition, for example, from ac or dc currents, ac fields, or mechanical friction. Good designs eliminate or accommodate all expected thermal disturbances so that superconductivity either is maintained or is recovered without difficulty. This technology broadly encompasses the electromagnetic, thermomechanical, cryogenic, and materials aspects of superconductive magnets uniquely developed for different applications. Wilson divides the subject into logical parts, derives the basic equations, works out examples, and provides needed data and insight for utilization.

The strongest chapters are the "timeless' chapters of basic phenomena. Chapter 5 covers in detail magnet degradation and training. Analytical derivations and representative graphs are well presented. Chapter 7 is a thorough analysis of flux jumps, filamentary composites, dynamic stability, and other analytical tools needed for conductor design. Chapter 8, on time-varying fields and ac losses, is very well presented and can be understood with only a modest mathematical or electromagnetic background. All practical aspects of protection, quench analysis, and propagation velocities are covered. The electrothermal analyses of these subjects are the core of this valuable book.

The references and technology are circa 1980–81. Two important applications not covered in Chap. 2 are large and small superconductive magnetic energy storage systems, and magnetic resonance imaging magnet systems. Chapters 3 and 4 could be expanded to more complicated force and stress considerations emphasizing computer codes. Chapter 6 could be expanded to include recent work with superfluid helium cryogenic stabilization.

In summary, anyone interested in superconducting magnets should study this book. It is a superlative reference for the serious designer and an excellent textbook.

Roger W. Boom has been active in applied superconductivity since 1960 when he formed the first applied superconductivity engineering group at Oak Ridge National Laboratory. From 1963 to 1968 he supervised a research and preproduction applied superconductivity group at Atomics International. Since 1968 he has directed an interdisciplinary applied superconductivity team at the University of Wisconsin- Madison, initially around the long-term superconducting magnetic energy storage project.

Yehia M. Eyssa is a senior scientist at the Applied Superconductivity Center (ASC) at the University of Wisconsin-Madison. He has been in charge of the magnetic and system design group of the ASC for the past 7 years. His responsibilities include analytical and numerical calculations of fields and forces in magnetic systems, configurational analysis, and system optimizations.